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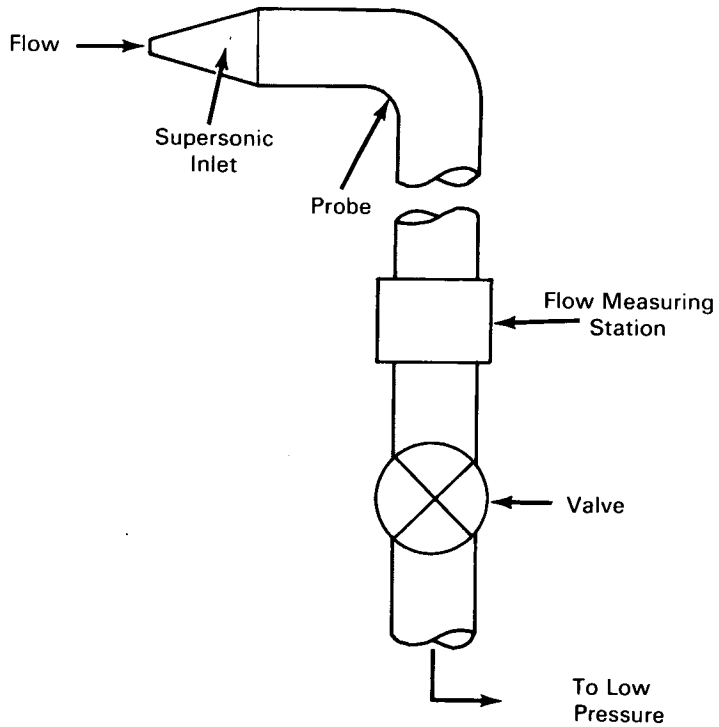
NASA TECH BRIEF

A Mass Flux Probe for Measurement in a Supersonic Stream



SCHEMATIC OF SYSTEM

The problem:

Problems exist in measuring parameters such as temperature, pressure, velocity, density and enthalpy in several areas of experimental fluid mechanics involving high-energy, high-velocity gas streams. Investigators are continuously searching for new instruments and/or techniques to measure these parameters and others relating to the flow field.

The solution:

Preliminary experiments and analysis indicate that a supersonic mass flux probe previously used in low-density, low-energy gas flow environments may be applied to more severe environments such as encountered in supersonic and hypersonic propulsion applications and magnetohydrodynamic generators. Furthermore, when this probe is used alternately as, or in conjunction with, a pitot tube, stream density and velocity can be obtained.

How it's done:

The probe consists essentially of a tube with a supersonic inlet pointed into the gas stream. Sufficient pressure drop must be provided across the inlet to

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"swallow" the shock and ingest the steam flow tube. The mass flow rate through the tube is then determined at a flow measuring station. A quantity which is the product of the steam density and velocity can then be calculated with knowledge of the probe inlet capture area. After obtaining this measurement, the flow is "valved-off" and the probe operates as a pitot tube. This measured pitot tube pressure is related to a term involving density and the square of the velocity. The information gained with this duo-mode operation is, therefore, sufficient to separate and evaluate the quantities of density and velocity. These measurements can also be used in mass-weighting a temperature profile and in determining enthalpy.

Note:

Documentation for the innovation is available from:

Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Price $3.00
Reference: B68-10533

Technical questions concerning this innovation may be directed to:

Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B68-10533

Patent status:

No patent action is contemplated by NASA.

Source: Lloyd N. Krause and George E. Glawe
(LEW-10695)